

## ***Chapter 13***

# **Cumulative Effects and Interdisciplinary Analysis**

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### 13.1 Primary Issues

This chapter contains two tables that note the major interrelationships among the ten environmental topics addressed in Chapters 3 through 12. [Table 13-1](#) notes the existing interrelationships and [Table 13-2](#) notes interrelationships among project impacts and mitigation measures.

In a complicated assessment such as this, environmental issues often overlap. For example, vegetation restoration involves slope stability, water quality, groundwater recharge, wildlife habitat, visual effects, and the marine environment.

The primary issues analyzed in this chapter are:

- How do the current elements of the environment relate to one another?
- How do project-specific impacts and mitigation measures relate among the various elements of the environment?
- How do resource-specific mitigation measures affect impacts and mitigation for other elements of the environment?

### 13.2 Affected Environment

The SEPA Rules define the environmental elements to be considered under SEPA (WAC 197-11-444). But the environment is more than a group of separate elements; it is the product of all these elements combined.

The environment of the site is the product of human, geologic, climatic, and biological processes and features. The environment is dynamic, constantly in flux, and involves complex interactions between these processes and features.

Table 13-1 illustrates the existing interactions among the various elements of the environment.

## 13.3 Impacts

### 13.3.1 How do project-specific impacts relate among the various elements of the environment?

Table 13-2 lists the major interactions among project impacts and mitigation measures. The following sections provide more detail regarding two particularly noteworthy areas of interaction.

**Shoreline Bluffs.** The bluffs along the shoreline of the site involve more environmental topics that perhaps any other site feature.

Air quality is related to the bluffs in that the required shoreline buffer would create a “wall” between the shoreline and the interior portion of the site. Figures 2-3 and 11-9b show the final grade and the bluffs that would remain under the Proposed Action (see also Chapter 11). The remaining bluffs would serve to reduce the potential of airborne materials moving from the interior to the shoreline, although impacts on air quality are not expected, even without considering the effects of the bluffs (Chapter 3). Still, the bluffs would serve to protect air quality.

Similarly, the bluffs could reduce project-generated sound where the bluffs separate residences from noise sources.

The bluffs also shield much of the site from view, and are themselves the most visible part of the site. Diminishing the height of the bluffs would change the visual character of the site, and this change could be seen from the shoreline of Maury Island, as well as from across Puget Sound.

In terms of geology, the bluffs are related to the potential for major slope failure. Major slides have occurred throughout Puget Sound, and many fear that mining at the Maury Island site might trigger such slope failures. However, mining would actually reduce the chance of slope failure. The existing slopes are prone to failure and removing a portion of these bluffs would reduce the total area prone to failure. The remaining bluffs could be maintained stable using appropriate landscaping and grading, as would be defined in the final plans (and refined during final grading operations).

Mining of the bluffs would also affect madrone forest and associated wildlife habitat, as described in Chapter 5. The amount of plant material and soils transported to the shoreline would be reduced by about half the levels under current conditions.

**Relationship between Reclamation and Containment of Arsenic and Lead.** Since the site is contaminated with arsenic and lead, vegetation could contain some of these hazardous materials. However, this is not a major concern, since this concern could be eliminated by testing and, if necessary, proper disposal of the materials. Arsenic is expected to be present in plants at trace levels and, if present, would be managed appropriately.

Under Alternative 1, reducing hours of mining would reduce much of what people would see and hear during nighttime. In addition, many marine organisms are nocturnal, and the elimination of barge loading during nighttime would reduce the amount of noise disturbance.

Under Alternative 2, the further reduction in mining hours would increase the number of hours during the day when people would hear and see relatively little activity from the mine. This increase would mostly add hours when most people are awake.

Under No-Action, the bluffs would probably remain as is indefinitely.

### **13.3.2 How do resource-specific mitigation measures affect impacts and mitigation for other elements of the environment?**

Some potential mitigation measures for one element of the environment can affect other elements of the environment, either positively or negatively.

**Bluff Protection – Visual Mitigation 1.** Because the bluffs involve so many elements of the environment, protection of the bluffs would provide environmental benefits for many elements of the environment. Retention of the bluffs was included as a potential mitigation measure in Section 11.4.3.2.

Many people object to the visual effects the mining operation would have, feeling that such a sight would be a major impact on quality of life. As proposed, much of the site would be shielded by the bluffs retained within the shoreline setback required under the Shoreline Management Act. However, visual screening could be

increased with a greater proportion of the bluffs being preserved (Section 11.4.3.2).

Protecting and preserving a greater portion of the bluffs would also:

- reduce the potential for dust to move from the interior of the site to along the shoreline;
- protect and preserve more madrone forest, including habitat for band-tailed pigeon (a species of local importance, as defined in the King County Comprehensive Plan);
- maintain the current flow of sand, dirt, wood, leaves, and other materials to the shoreline; and
- provide greater achievement of KC Policy NE-604, which, in part, calls for protection of riparian corridors (riparian areas are land and vegetation that interacts with aquatic areas, such as streams, lakes, and marine areas).

**Containment of Contaminated Soils.** The contamination of the site precludes use of top soils for reclamation. This obviously relates to site reclamation. Madrone can be established without top soil augmentation, as has been demonstrated by natural colonization within previously mined areas. Some soil augmentation may be necessary to encourage other plants to develop. Over time, soils would develop naturally.

## 13.4 Cumulative Effects

Cumulative effects (impacts) involve the collective consideration of several individual impacts. Many actions that have relatively minor effects on the environment when considered by themselves can have major effects when considered collectively with impacts from other sources. For example, impacts on regional air quality from one source can be negligible, as is the impact of a single car on traffic. However, as is evident throughout King County, collectively, all cars have tremendous impact on air quality, traffic, and the quality of life.

Cumulative impacts can be viewed in two ways. First, the impacts of a specific project can be considered together with impacts from independent projects, including those occurring in the past, present, and reasonably foreseeable future. Chapters 3 through 12 addressed this type of cumulative impact by considering impacts directly attributable to the proposal together with similar impacts

attributable to independent sources. For example, loss of madrone forest due to mining at the site was considered collectively with the loss occurring throughout the region due to development.

The second way cumulative impacts can be viewed is to consider multiple impacts that occur at the project scale. As noted in SEPA, WAC 197-11-330, “several marginal impacts when considered together may result in a significant adverse impact.” Many public comments on the DEIS stated that King County did not adequately address cumulative impacts across elements of the environment. The DEIS addressed cumulative effects for each resource but did not address all the effects collectively. This section addresses this second way of considering cumulative effects.

Predicting significance of the cumulative effect of project impacts requires judgement, since no formula is available to interpret and define such impacts. For this section, the most notable impacts are simply presented collectively for review, consideration, and disclosure of the cumulative effect of the project.

Surface mining, by its very nature, is an intensive land use, involving large-scale clearing of vegetation and movement of soils and minerals. It requires heavy equipment, trucks, conveyer systems, sorting machines, and transportation systems. These, in turn, create many unavoidable adverse impacts on the environment, including loss of wildlife habitat, visual and physical changes to the landscape, and creation of noise and traffic.

King County Resource Land Policy RL-411 lists the following impact areas as being particularly associated with mining operations:

- (a) Air quality,
- (b) Environmentally sensitive areas,
- (c) Noise levels,
- (d) Vibration,
- (e) Light and glare,
- (f) Vehicular access and safety,
- (g) Visual impacts,
- (h) Cultural and historic features and resources, and
- (i) Site security.

For this project, the most notable adverse impacts were determined to be on environmentally sensitive areas (Chapters 5 and 6) and the visual environment (Chapter 12). These impacts are as follows:

- Rockfish, cod, and other sensitive species would be reduced or eliminated underneath and near the barge loading area.
- Mature madrone forest would be converted to young madrone forest. These young forests would take 50 years or more to approximate the functional values of existing forests and may never totally replace the loss. This loss would reduce wildlife habitat values on the site, including habitat for band-tailed pigeon and other sensitive species.
- Mining would visually and physically alter the site. People living along the shoreline in the Sandy Shores and Gold Beach communities would regularly see barges come and go as well as the exposed active areas of the mine. Some views would be screened by the existing bluffs.

As documented in Chapters 3 through 12 and in [Table S-2](#), large scale mining at the Maury Island site would cause many other adverse impacts that cannot be completely avoided. These impacts should be considered collectively by the decision-maker when making decisions regarding the proposal.

Finally, one last consideration related to cumulative effects is the potential for the project to establish a precedent for future actions with significant effects. However, the project, and King County's decisions regarding it, would not set a precedent that would result in more gravel mines being developed. The number of potential sites is very limited, as defined in the King County Comprehensive Plan. The Maury Island site is the only shore-based area zoned for mining on King County. With this lack of available sites, additional shore based mining being proposed in King County is unlikely.

Some decisions about the proposal may establish a precedent for how projects are evaluated and conditioned in shoreline areas. This is the first major shore-based proposal evaluated by King County since the listing of the Puget Sound Chinook salmon as threatened. During consultations with the WDFW, their biologist assigned to this project noted concern that impacts and project conditions established for this project may be applied at others projects that are reasonably likely to occur throughout Puget Sound.

**Table 13-1. Interrelationships Among Various Elements of the Environment**

<i><b>Air</b></i>	<i><b>Geology/ Hydrogeology</b></i>	<i><b>Terrestrial Plants and Animals</b></i>	<i><b>Marine Environment and Fisheries</b></i>	<i><b>Noise</b></i>	<i><b>Transportation</b></i>	<i><b>Land Use</b></i>	<i><b>Environmental Health and Safety</b></i>	<i><b>Visual and Aesthetics</b></i>	<i><b>Recreation</b></i>
<b>Air</b>									
					Fog and bad weather can complicate shipping	People who live on Vashon/ Maury island enjoy many aspects of rural life, including clean air	Arsenic and other materials have settled on the site from polluted air.		
<b>Geology/Hydrogeology</b>									
The site contains open areas from past mining that are exposed to wind erosion, although this is not currently a major problem at the site.		Dry, well-drained soils at the site, as well as the steep bluffs, provide ideal conditions for madrone forest.	The steep bluffs contribute soils to the shoreline. The topography of the site continues into offshore water, where ridges jut out, and then slope sharply into deeper water.		The shoreline location provides opportunity for sea-based transportation.	The site is rich with sand and gravel that make excellent structural fill, a resource that is in high demand as the region grows.		Past mining has created a large open area in the central portion of the site. The topography creates bluffs and shoreline that are a major part of the visual environment.	The beach along the site provides recreation opportunities.
<b>Terrestrial Plants and Animals</b>									
	Madrone on the bluffs help prevent erosion and landslides.		Forested bluffs contribute organic and inorganic material to the shoreline.	Artificial noises can affect many wildlife species.				Forests on the site impart a natural appearing view of most of the site.	



**Table 13-1. Continued**

<b>Air</b>	<b>Geology/ Hydrogeology</b>	<b>Terrestrial Plants and Animals</b>	<b>Marine Environment and Fisheries</b>	<b>Noise</b>	<b>Transportation</b>	<b>Land Use</b>	<b>Environmental Health and Safety</b>	<b>Visual and Aesthetics</b>	<b>Recreation</b>
<b>Marine Environment and Fisheries</b>									
	The shoreline is a dynamic geologic system, involving complex interactions of tides, currents, and wave action that act on and interact with the physical and biological elements of the marine and terrestrial environments.	The shoreline introduces diversity to the site, with some species, such as bald eagle, using both marine and terrestrial environments.				The shoreline is protected under the Shoreline Management Act as well as various policies defined in the King County Comprehensive Plan		The shoreline is a major element of the visual environment.	The dock is a major attraction for recreational divers, and the shoreline is used by residence as open space. People fish near the site and sometimes collect shellfish at the site.
<b>Noise</b>									
		Animals are sensitive to noise.	Marine animals are sensitive to noise and vibration.			The relatively quiet nature of the area is valued by local residents.		Noise is an important element of the overall aesthetic environment.	The quietness of the site is part of the experience enjoyed by people that currently use the site.

**Table 13-1. Continued**

<b>Air</b>	<b>Geology/ Hydrogeology</b>	<b>Terrestrial Plants and Animals</b>	<b>Marine Environment and Fisheries</b>	<b>Noise</b>	<b>Transportation</b>	<b>Land Use</b>	<b>Environmental Health and Safety</b>	<b>Visual and Aesthetics</b>	<b>Recreation</b>
<b>Transportation</b>									
Existing shipping from Tacoma produce some air pollution.	Roads on the site affect surface water flow and create compacted and impermeable surfaces.		Many large commercial vessels and many recreational vessels travel past the site and Quartermaster Harbor. The existing dock and sunken barges create artificial "reef" habitat.	Recreational and commercial vessels can often be heard along the Maury Island shoreline.		The waters of Maury Island are an important shipping corridor.		Recreational and commercial vessels can often be seen along the Maury Island shoreline.	Recreational and commercial vessels must negotiate movement around other vessels.
<b>Land Use</b>									
	The site is a designated mineral site.	Natural Resource Lands, such as designated mineral sites, also preserve wildlife by preventing other types of development on such lands.	The shoreline is protected under the Shoreline Management Act as well as various policies defined in the King County Comprehensive Plan.	Loud, intrusive noises can conflict with the rural designation and character of surrounding areas.				The rural character of the surrounding areas is protected under King County Code and the Comprehensive plan, as is the use of the site for mineral extraction.	The site is private and recreational use is done without permission. Recreational use of the shoreline, however, is protected under King County's Shoreline Master Program.
<b>Environmental Health and Safety</b>									
	Arsenic and other metals have contaminated the upper layers of the soil.	Plants may have taken up trace amounts of arsenic and other materials.	The existing dock is leaching creosote.						

**Table 13-1. Continued**

<i><b>Air</b></i>	<i><b>Geology/ Hydrogeology</b></i>	<i><b>Terrestrial Plants and Animals</b></i>	<i><b>Marine Environment and Fisheries</b></i>	<i><b>Noise</b></i>	<i><b>Transportation</b></i>	<i><b>Land Use</b></i>	<i><b>Environmental Health and Safety</b></i>	<i><b>Visual and Aesthetics</b></i>	<i><b>Recreation</b></i>
<b>Visual/Aesthetics</b>									
						The site provides views of forested bluffs, which are valued by nearby residents.			The existing natural appearance of much of the site attracts recreational use at the site.
<b>Recreation</b>									
Unauthorized use of the site by motorcycles produce dust.		People enjoy hiking and horsebacking through the forests and seeing wildlife that use the site.	The shoreline is an important recreational resource.	Unauthorized use of the site by motorcycles produces dust.	Recreational and commercial vessels must negotiate other vessels.		People are using areas contaminated by metals.		

**Table 13-2. Interaction Among Elements of the Environment – Impacts and Mitigation**

<i>Air</i>	<i>Geology/ Hydrogeology</i>	<i>Terrestrial Plants and Animals</i>	<i>Marine Environment and Fisheries</i>	<i>Noise</i>	<i>Transportation</i>	<i>Land Use</i>	<i>Enviromental Health and Safety</i>	<i>Visual and Aesthetics</i>	<i>Recreation</i>
<b><i>Air</i></b>									
						Dust would not travel to adjacent properties or roads, or otherwise conflict with existing land use.	Dust from topsoil removal could contain arsenic. Burning of vegetation could also contain arsenic.		
<b><i>Geology/Hydrogeology</i></b>									
The moist sand and gravel at the site is not likely to become air borne.			Alterations of the bluffs would reduce the flow of soils to the marine environment.			Standard engineering would be applied to prevent slides that could affect adjacent land use.		The light colored sands, once exposed, would present visual contrasts.	
<b><i>Terrestrial Plants and Animals</i></b>									
Retention of more of the bluffs may reduce the potential for dust to leave the site.	Establishing vegetation following mining also prevents erosion.		Protection of more bluffs would enhance riparian functions of the bluff.	Protection of more bluff area could reduce some noise leaving the site.				Retention of more bluffs would increase visual screening of active mining areas.	
<b><i>Marine Environment and Fisheries</i></b>									
		Shoreline enhancement for salmon would also enhance habitat for terrestrial plants and animals.		Fitting a downspout on the end of the conveyor may reduce noise from barge loading.					Active mining areas would not be available for recreational fishing or diving.

**Table 13-2. Continued**

<b>Air</b>	<b>Geology/ Hydrogeology</b>	<b>Terrestrial Plants and Animals</b>	<b>Marine Environment and Fisheries</b>	<b>Noise</b>	<b>Transportation</b>	<b>Land Use</b>	<b>Enviromental Health and Safety</b>	<b>Visual and Aesthetics</b>	<b>Recreation</b>
<b>Noise</b>									
		Animals would avoid active areas of the mine, in part due to noise.	Noise and vibration from barge loading would cause some fish to avoid the area.			Residents would be able to hear the mining operation, although the King County Noise Ordinance would not be violated.		Noise from the conveyor belt and active mining would affect the overall character of the surrounding communities.	
<b>Transportation</b>									
Heavy equipment, tugs, and trucks would produce some dust and exhaust emissions			Tug and barge traffic would introduce additional disturbance to the marine environment.	Tugs and barge loading would produce noise and vibrations that would cause some marine organisms to avoid the area.		Barging and elements of mining would occur within the shoreline, which is designated as a conservancy environment.		Barges and tugs would be visible to residents of the Maury Island shoreline.	Tugs and barges would prevent recreational diving at the site.
<b>Land Use</b>									
				Mining, with associated noise, is an allowed use within rural areas.	The shoreline is designated as conservancy, and barge operations would be a non-permitted use.				Recreational access to the shoreline would need to be allowed, although the experience would be altered due to active barge loading.

**Table 13-2. Continued**

<i>Air</i>	<i>Geology/ Hydrogeology</i>	<i>Terrestrial Plants and Animals</i>	<i>Marine Environment and Fisheries</i>	<i>Noise</i>	<i>Transportation</i>	<i>Land Use</i>	<i>Enviromental Health and Safety</i>	<i>Visual and Aesthetics</i>	<i>Recreation</i>
<b>Enviromental Health and Safety</b>									
Arsenic and lead would need to be managed to avoid air pollution.		Arsenic and lead in topsoils would prevent its use for reclamation. Cleared vegetation would need to be checked for contamination.							
<b>Visual/Aesthetics</b>									
									Changes in views would adversely affect recreational experiences.
<b>Recreation</b>									
		People using the site could disturb wildlife							